Figure 1(a)

Figure 1(b)

Figure 2
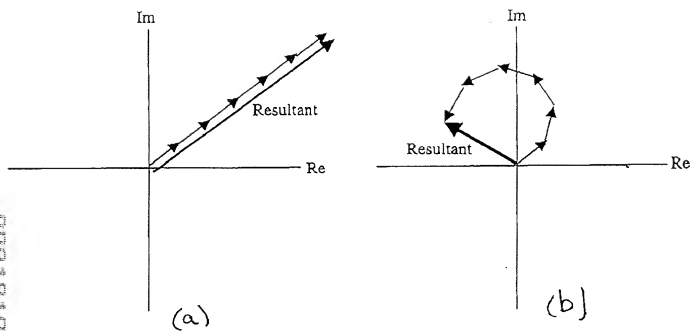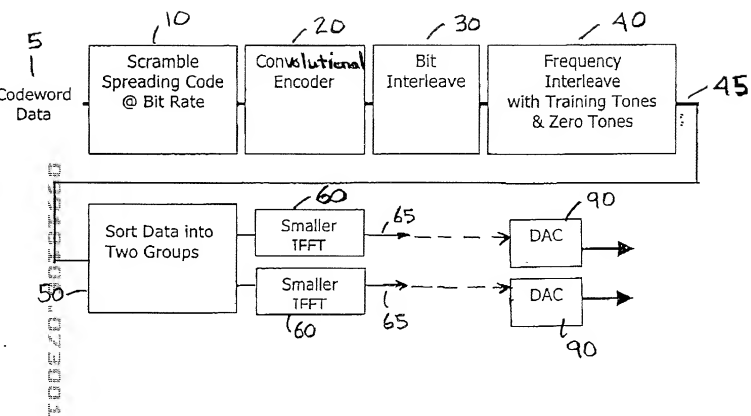

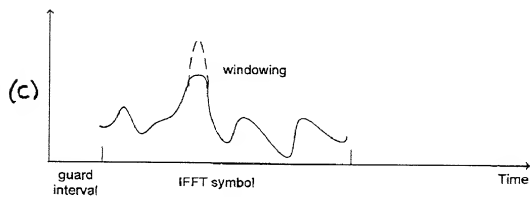Peak-to-Average Ratio

Figure 3

```
  5
  |
Codeword ──  ┌──────────────┐   ┌──────────────┐   ┌──────────────┐   ┌──────────────────┐
   Data      │   Scramble   │   │ Convolutional│   │     Bit      │   │    Frequency     │ ── 45
             │Spreading Code│──▶│   Encoder    │──▶│  Interleave  │──▶│    Interleave    │
             │  @ Bit Rate  │   │              │   │              │   │ with Training Tones│
             │              │   │              │   │              │   │   & Zero Tones   │
             └──────────────┘   └──────────────┘   └──────────────┘   └──────────────────┘
               ╱10               ╱20                ╱30                ╱40
```

```
                            ╱60             ╱65                ╱90
             ┌──────────────┐  ┌──────────┐                ┌──────────┐
             │Sort Data into│  │ Smaller  │                │   DAC    │ ──▶
             │  Two Groups  │─▶│   IFFT   │── ─ ─ ─ ─ ─ ─ ▶│          │
             │              │  └──────────┘                └──────────┘
             │              │  ┌──────────┐                ┌──────────┐
             │              │─▶│ Smaller  │─ ─ ─ ─ ─ ─ ─ ─▶│   DAC    │ ──▶
             └──────────────┘  │   IFFT   │                │          │
   50                          └──────────┘                └──────────┘
                                ╲60       65                    ╲90
```

(a) IFFT Output

guard interval   IFFT symbol   Time

(b) Window Function

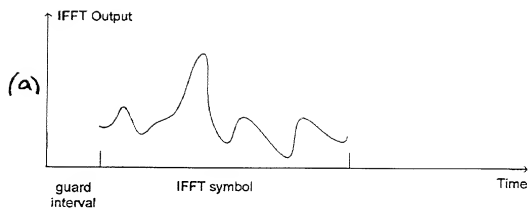guard interval   IFFT symbol   Time
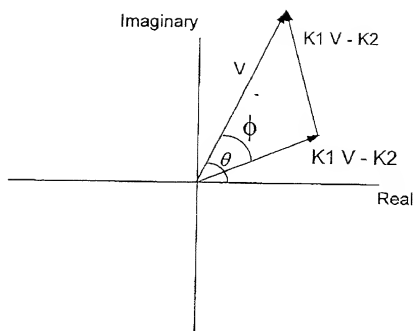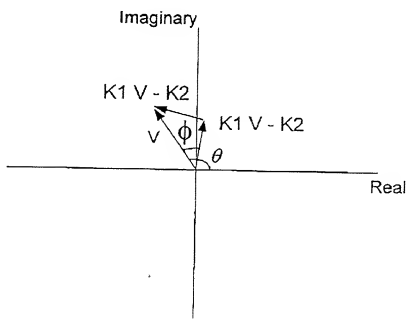
(c) windowing

guard interval   IFFT symbol   Time

Figure 4

(a)   Signal at Time 1

(b)   Signal at Time 2

Figure 5

Figure 6

```
┌─────────────────────────────────────────────┐
│   List all complex values (representing all   │
│        time samples) in time sequence         │
│             for one OFDM symbol               │
└─────────────────────────────────────────────┘
                       │
                       ▼
┌─────────────────────────────────────────────┐
│  Measure VMAX and VMIN for the OFDM symbol    │
│     Determine proportionality constants for   │
│  the predetermined reduction in peak-to-      │
│             average power ratio               │
└─────────────────────────────────────────────┘
                       │
                       ▼
┌─────────────────────────────────────────────┐
│      Determine the VPHASOR amplitudes         │
│         Determine the $\phi$ phase            │
└─────────────────────────────────────────────┘
            │                      │
            ▼                      ▼
┌──────────────────┐     ┌──────────────────┐
│ Calculate complex │     │ Calculate complex │
│ values for phasor │     │ values for phasor │
│        #1         │     │        #2         │
└──────────────────┘     └──────────────────┘
            │                      │
            ▼                      ▼
┌ ─ ─ ─ ─ ─ ─ ─ ─ ┐     ┌ ─ ─ ─ ─ ─ ─ ─ ─ ┐
│   RF circuits    │     │   RF circuits    │
└ ─ ─ ─ ─ ─ ─ ─ ─ ┘     └ ─ ─ ─ ─ ─ ─ ─ ─ ┘
            │                      │
            ▼                      ▼
┌ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ┐
│               Combiner                  │
└ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ┘
                       │
                       ▼
```
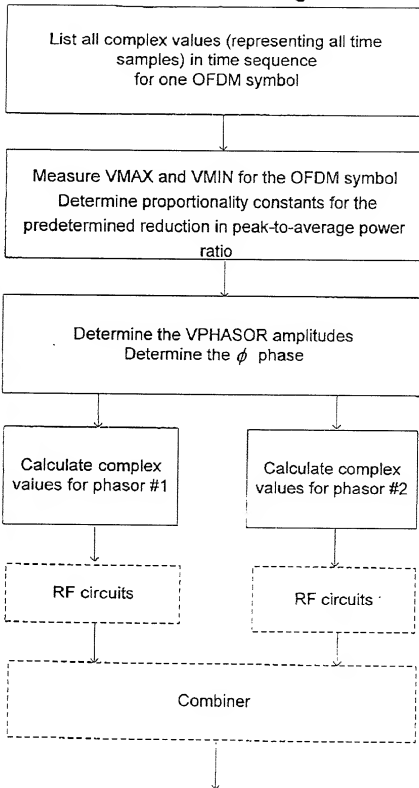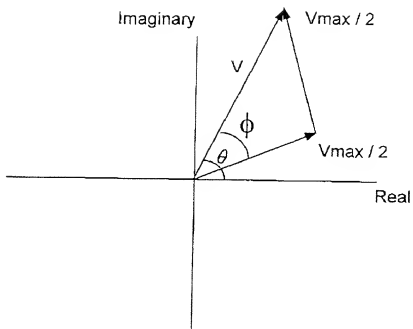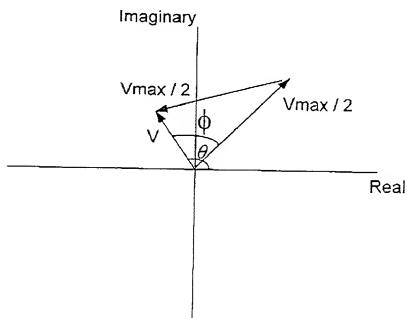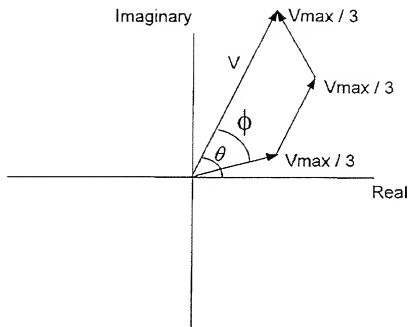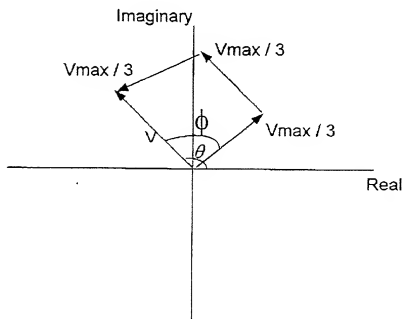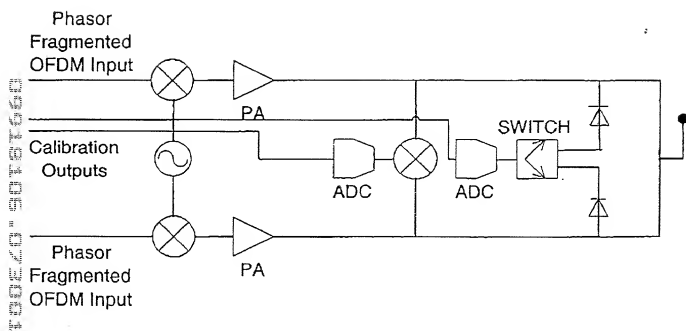
(a) Signal at Time 1

(b) Signal at Time 2

Figure 7

(a) Signal at Time 1

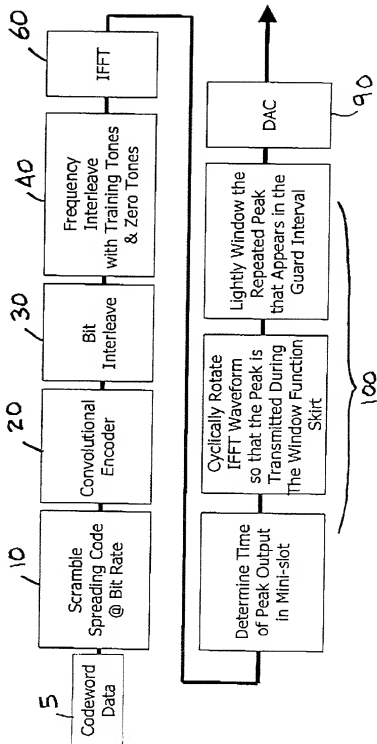(b) Signal at Time 2

Figure 8

Figure 9

IFFT Output

(a)

guard
interval

IFFT symbol

Time

Window Function

(b)

guard
interval

IFFT symbol

Time

Virtual Range-Hopped
(symbol windowed and light windowed)
IFFT output

(c)

light
windowing

symbol
windowing

guard
interval

IFFT symbol

Time

Figure 10

Figure 11